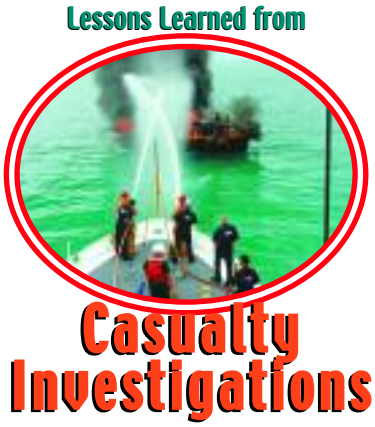
The Grounding of a Cruise Ship

A lesson in maritime management.



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It's a beautiful night in the Caribbean. You are taking a cruise on the ship, *Monarch of the Seas*. You've been dancing, eating, drinking, and having a wonderful time. You finally go to bed and rest for the next busy day of port calls and touring on Martinique. Suddenly, the ship shudders and shakes, and you are awakened by the captain's voice over the loudspeaker, stating that there has been an accident and to please move to the emergency stations.

How could this have happened? This is a modern vessel with many of the latest navigational aids. The officers and crew are all trained and certified. How could this beautiful vessel tear open its hull on a well-known coral reef on a clear night with a calm sea? Let's take a closer look at what actually happened very early on the morning of December 15, 1998.

The Incident

The ship was on its usual course from St. Thomas, U.S. Virgin Islands, to Martinique, when one of the passengers suffered a heart attack and required immediate shoreside medical treatment. The master deviated from his course to offload the passenger at Great Bay, St. Maarten, Netherlands, Antilles. This was safely accomplished at approximately 12:30 a.m., and the vessel prepared to depart once the doctor and nurse were back aboard the ship.

The doctor and nurse returned to the ship about 1:25

Figure 1: A shot of an interior stairway, showing water level. USCG photo.

a.m., and the master himself piloted the ship to pass to the east of the Proselyte Reef, not the usual departure route of the vessel. The master decided on this course based on his mariner's eye and the information from the officer of the watch (OOW) that the automatic radar plotting aid (ARPA) calculated the closest point of approach to the Proselyte Reef lighted buoy 3 cables off (0.3 nm), based on a course of 160 degrees true. The master felt that this would provide a safe passage around a known hazard and adequate clearance for a sailing vessel in the immediate area, and so he gave the orders to set sail for Martinique on this path.

About three minutes later, the master, not feeling well, left the bridge to retire to his stateroom. On the bridge were the staff captain, the OOW, and two quartermasters as the helmsman and the lookout. The master checked back in shortly after leaving to see if all was well. As almost a second thought and with a feeling that something was just not right, after he exited the bridge, the master immediately returned to ask if everything was okay. The OOW assured him it was, and the master left again.

Unfortunately, all was not well. Within another two to three minutes, the ship would tear a hole in its bottom on the sharp coral of Proselyte Reef. This occurred at about 1:30 a.m. The officer of the watch was instituting a starboard turn to 190 degrees, and the ship scraped against the reef and started to flood several of the compartments on its lower levels. Just before the turn that immediately led to the grounding, the OOW was distracted by a phone call on the bridge from the housekeeping staff, regarding a disturbance related to a loud party in a stateroom. The OOW was also required to silence a smoke alarm that had sounded on the bridge.

As soon as he felt the ship vibrate from contact with the reef, the master returned to the bridge and assumed the watch of the ship. At about 1:35 a.m. all of the watertight doors were ordered closed to prevent further flooding throughout the ship (Figure 1). Watertight door number 10 was later found open by the ship's safety officer and was then closed. After consultation with the senior officers and Marine Operations in Miami, the master decided to ground the vessel on a sand bank in Great Bay in St. Maarten.

At 1:47 a.m., the general emergency signal was sounded, and all passengers and crew were told to report to their emergency/abandon ship stations. The passengers were kept informed of what was happening over the public address system in French, English, Spanish, and German. By 2:20 a.m. all of the passenger cabins had been evacuated, and the lifeboats were prepared for evacuating the passengers from the ship.

At 2:35 a.m. the master intentionally grounded the ship on a sandbar in Great Bay, St. Maarten. Since this was accomplished successfully, the decision was

made to evacuate the passengers by tenders from St. Maarten rather than via the lifeboats. The evacuation was carried out by the shore-based tenders in about an hour and a half.

What Went Wrong?

As with many incidents, no single error caused it to happen. In fact, a whole series of unsafe actions, decisions, and conditions caused this incident. There were organizational errors, navigational errors, and individual human errors. While a multitude of errors happened prior to the incident, the investigators found no fault with the actions of the master or the other members of the ship's crew after the grounding.

One of the most critical organizational errors was the master's not following the standards and procedures as laid out in the ship's International Safety Management (ISM) manual, also known as the Safety Management System (SMS). Because of this neglect to follow the established procedures, the officers on the bridge:

- did not set down a formal, written passage plan for this particular deviation into St. Maarten;
- did not follow the departure checklist;
- did not know exactly where they were when departing St. Maarten, as no one had taken or plotted a navigational fix;
- relied on only one navigational instrument, the ARPA;
- relied on only one navigational aid, the Proselyte Reef lighted buoy;
- had not updated the charts to reflect the information in the latest Notice to Mariners.

This last item is critical, as the latest notice let mariners know that the Proselyte Reef lighted buoy the OOW was using to navigate had moved 125 meters west of the position on the ship's chart. If the vessel departed port in a customary fashion, followed the procedures set forth in the SMS, had practiced good seamanship, or had even done one of the previous three, this incident might not have occurred.

The navigational errors were numerous as well. The OOW did not take an initial fix on the ship's position and did not account for the current and wind in his calculations with the ARPA. The Officer of the Watch also relied solely on the automatic radar plotting aid and did not take a terrestrial fix or utilize the global positioning system (GPS) with which the ship was equipped. It is against best seamanship practices to use a buoy for navigation as well.

Not surprisingly, the human factors in this incident were also many. The master decided to sail to the east side of Proselyte Reef, which is contrary to the usual southwesterly departure passage. The route the master chose is the most dangerous side to transit, as the current moves in a westerly direction, the wind is normally easterly, and the lighted buoy they were navigating by is positioned on the west side of the reef. The master was also suffering from a cold, which caused him to leave the bridge suddenly, and he had a managerial style that did not encourage communication of suggestions or questions by his bridge officers. The other officers of the bridge took no initiative to prepare a passage plan, record the passage of the vessel on the navigation charts, or even take additional readings from any of the other navigational aids to ensure that the ship was where they thought they were.

Figure 2: The bridge layout on the *Monarch of the Seas* may have contributed to the incident. USCG photo.

What's the Bottom Line?

Of the multitude of mistakes made that led up to the grounding, many might have not occurred if the master had embraced and caused his crew to follow the procedures laid out in the SMS. This lack of "buy-in" to the SMS meant that the sensible and required

procedures in the manual were not followed. According to the lead Coast Guard investigator, if the procedures had been followed, the grounding would not have taken place. Why did the master not follow the SMS procedures? Whatever the reason(s), this and the other failures of the bridge team made this incident inevitable.

Recommended Solutions

There were many safety actions recommended to the cruise line. The most important and broad-reaching were:

- The company should establish a check and balance system whereby a designated officer, such as the safety officer or staff captain, shall independently verify and document compliance with ISM SMS guidelines, procedures, and job aids.
- The company should require ISM training for all ship's officers in its fleet.
- The company should market and promote the benefits of the SMS to all vessel crewmembers.

The ISM SMS intends the bridge officers to work as a team, with checks and verifications of tasks accomplished, to ensure the safe passage of the vessel from port to port. This navigational watch did not operate as a team, in support of one another. There was evidence that the master's strong and sometimes abrasive personality created reluctance among the crew to disagree or question the master's decisions. This attitude of unquestioning subservience established an unsafe condition, when combined with the master's confidence and familiarity with the areas the ship was transiting. The casualty report suggested that:

- The company's human resources personnel should develop and implement a personnel-screening program to ensure that ship masters and watch standing personnel hired or employed are suitable for the positions they intend to hold, bearing in mind the importance of teamwork and open communications.
- The company should provide bridge resource management training for all navigational watch standing personnel.
- The company should implement a team-building training program for all watch standing personnel.
- The company should design and implement a training program specifically targeting senior officers, regarding effective communications and effective teamwork with subordinates.

These suggested safety improvements would also address the lack of teamwork that was seen in this casualty. As stated in the casualty report:

"The lack of teamwork arose, due to the master's failure to involve the watch standers in the decision-making process regarding the St. Maarten departure route, as well as the ambiguity created by the master's confidence and overbearing presence. The senior members of the navigational team, the OOW and the staff captain, both expressed their surprise at the unusual and more dangerous departure course chosen by the master that took the vessel to the east of the Proselyte Reef, but failed to express their concern because they did not feel empowered to voice doubt in the master's decisions."

The investigators also found that there were ergonomic and human performance issues in the way the OOW conducted himself in this incident. The decision to rely solely on the automatic radar plotting aid to plot the Proselyte Reef lighted buoy as the sole reference point was contrary to the rules of good seamanship, his training as a navigational officer, and the vessel's established standard procedures. This lapse can be attributed to the human tendency to take the path of least resistance and do the easiest thing to get the job done.

This was combined with a poor layout of the navigation station, which made it much more difficult to watch and use the ARPA as well as the other navigational aids aboard the vessel, such as the GPS receiver. The chart table was placed well away from the automatic radar plotting aid, which was at the forward starboard side of the bridge. While this position for the ARPA allowed a good view of any traffic on the burdened or starboard side of the ship, unfortunately, all other navigation instruments and the charts were located aft and well away from that position (Figure 2). This required the navigational watch officer to physically move around the chart table to the rear and away from the automatic radar plotting aid.

It was also discovered in the investigation that the navigational watch officers relied heavily on the electronic instruments, rather than taking terrestrial navigational fixes. Taking terrestrial navigational fixes is somewhat time-consuming, requiring the placement

of the azimuth bearing circles on the gyro repeaters (Figure 3), taking several bearings, and then plotting them on a chart. On this vessel, this was made more difficult by the physical layout of the ship. The gyro compass repeaters were blocked by equipment cowlings that allowed only minimal physical clearance. It was no small wonder to the investigators that the navigation watchstander did not use this method to verify the ship's position at any time.

Figure 3: The exterior starboard bridgewing repeater. USCG photo.

The OOW also failed to fully utilize the automatic radar plotting aid's capabilities. He never ground locked the ARPA nor did he manually input the wind and current values that would have allowed the ARPA to calculate the vessel's set and drift. If he had, he might have realized that the ship was a lot closer to the reef than he thought.

The recommended safety actions to address these issues were:

- The company should require all navigational watch officers to attend ARPA certification and periodic refresher training.
- The company should develop a brief, in-house ARPA training refresher course on training aids that navigational watch officers must successfully complete on an annual basis, or when first assigned to a particular vessel.
- For each vessel owned and operated by the company, personnel should examine the physical bridge layout and work with the vessel's navigational watch officers to modify the design to permit the most effective, efficient, and safe navigation of the vessel. This examination should take into consideration locating navigation charts and plotting tools as well as electronic navigation instruments readout in close proximity to the primary navigating station.

Other issues that were addressed by the investigation team were the lack of corrections to the charts, the neglect to use the charts to plot the vessel's passage, and the function of the OOW and that of the staff captain. To prevent these types of issues from reoccurring, the investigators suggested that:

- The casualty report should be distributed throughout the company fleet and made required reading for the officers and all navigational watch standers.
- The company should completely separate hotel management responsibilities from the bridge crew to ensure that hotel problems do not compromise the safety of the ship.

Lessons Learned

The investigation team found 20 different lessons learned, which can be summarized:

- Operate as a team and communicate clearly with each other, especially when making an emergency or non-routine operation.
- Plan passages and make written records of the plans.
- Keep charts current and corrected.
- Practice good seamanship and do not be over-confident about your abilities or those of your ship or the ship's instruments.

About the author: *Ms. Kristé Stromberg has a bachelor's degree in general studies science from Portland State University with mechanical engineering, physical science, and history coursework. Before becoming a technical writer, Ms Stromberg worked in libraries, museums, and archives, primarily conducting research and developing exhibits. She has worked for the Coast Guard with several different contractors since 1996.*